

FIG. 1

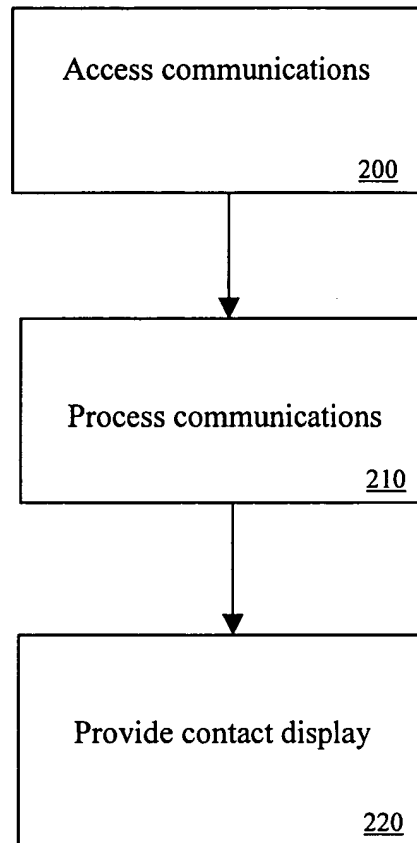


FIG. 2

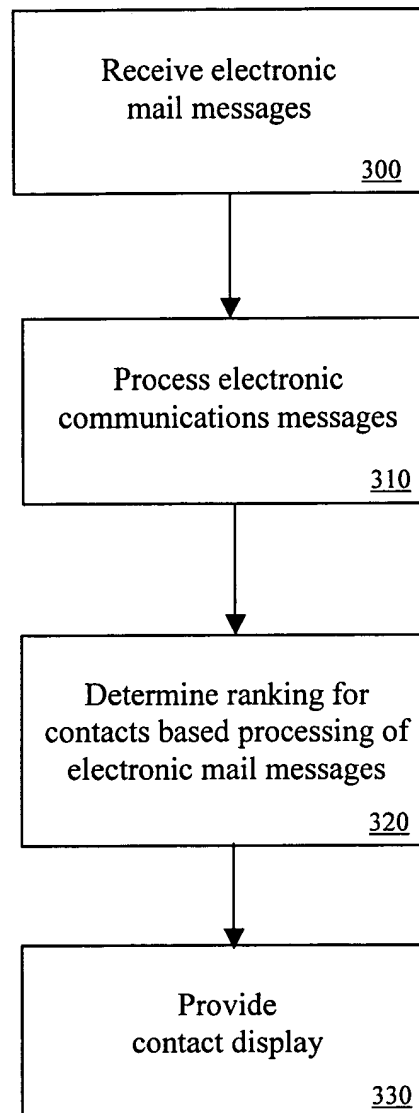


FIG. 3

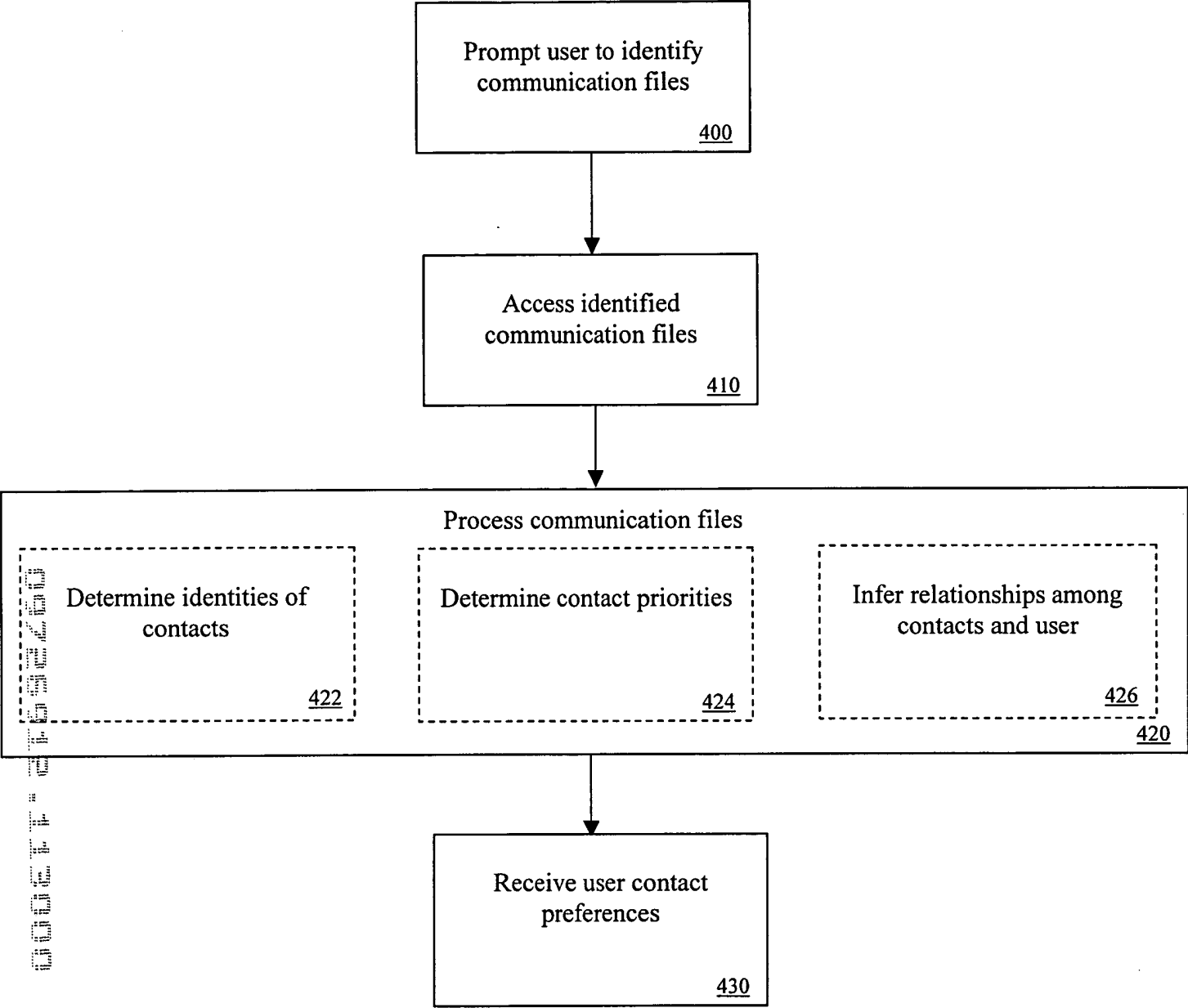


FIG. 4

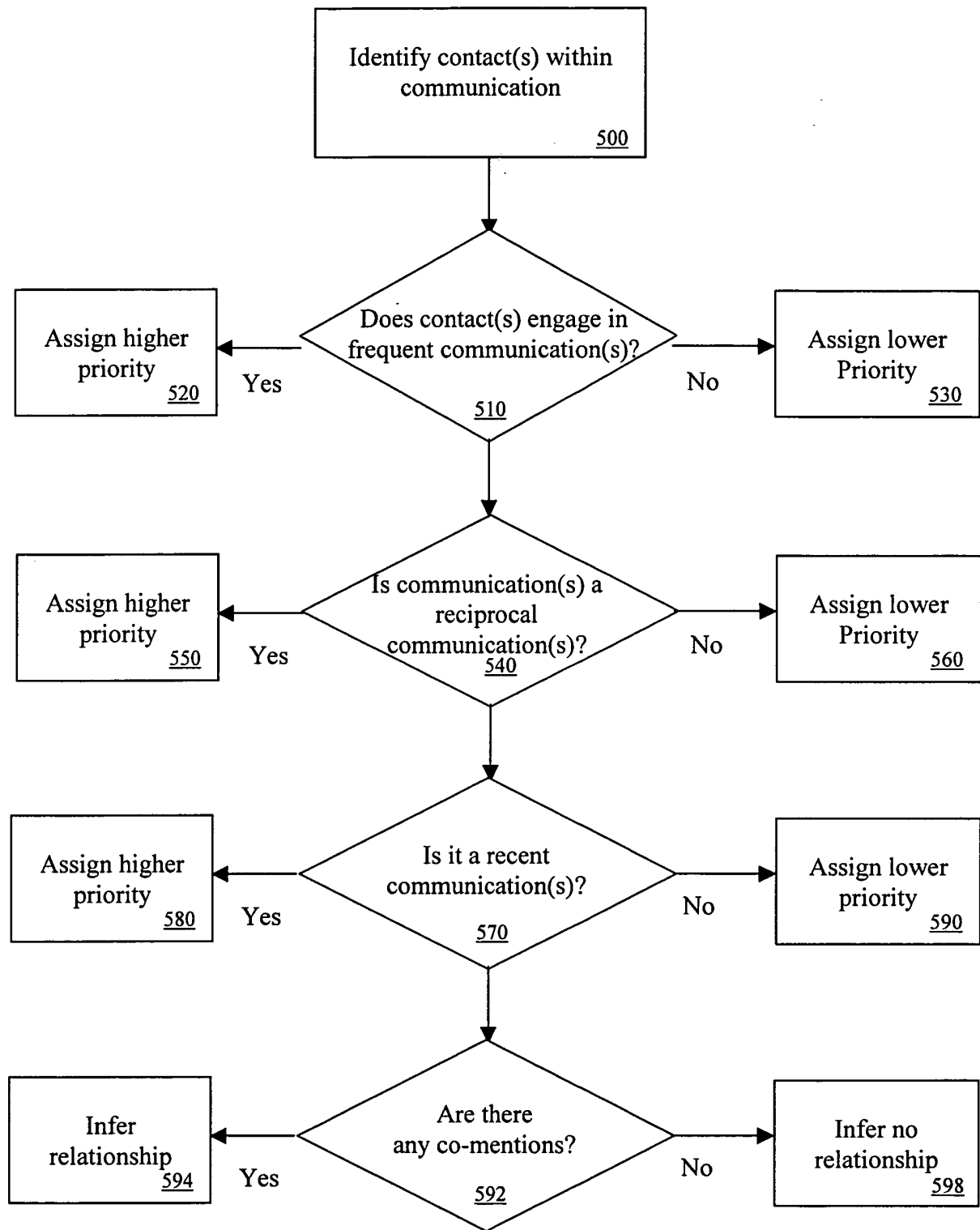


FIG. 5

650

FIG. 6

```

/* --Java--
*****
*
* File:          MATContactCounts.java
* RCS:           $Header: $
* Description:
* Author:        John Hainsworth
* Created:       Fri Sep 03 15:17:42 1999
* Modified:      Thu Sep 09 16:15:41 1999 (Michael L. Creech) mike@home
* Language:      Java
* Package:       com.att.research.mat.email
* Status:        Experimental (Do Not Distribute)
*
* (c) Copyright 1999, AT&T, all rights reserved.
*
*****
*
* Revisions:
*
* Thu Sep 09 16:15:31 1999 (Michael L. Creech) mike@home
*   Added getOldest(), and getNewest().
* Fri Sep 03 15:17:46 1999 (Michael L. Creech) mike@home
*   Made getOrderingValue() public.
*****
*/

package com.att.research.mat.email;

import java.io.PrintWriter;
import java.io.IOException;
import java.util.Date;

/** Statistics about mail to and from one e-mail address.
 * These statistics are all redundant with respect to the data,
 * so none of them are saved with the data.
 */

public class MATContactCounts {
    /** Copyright (c) 1999 AT&T Labs */
    static public String Copyright = "Copyright (c) 1999 AT&T Labs";

    static final private int CountNONE = -1;
    static final private double DCountNONE = -1.0;

    static final int FromME = 0;
    static final int FromOTHER = FromME + 1;
    static private final int From_N = FromOTHER + 1;
    static private final String StrFrom[] = { "My", "" };

    /** seen in an original message */
    static final int KindCOMPOSITION = 0;
    /** seen in a reply message */
    static final int KindREPLY = KindCOMPOSITION + From_N;
    /** seen in a forwarded message */
    static final int KindFORWARD = KindREPLY + From_N;
    static private final int Kind_N = KindFORWARD + From_N;
    static private final String StrKind[] = { "", "Repl", "Fwd" };

    /** seen in a "To:" header */
    static final int WhereTO = 0;
    /** seen in a "From:" header */
    static final int WhereFROM = WhereTO + Kind_N;
    /** seen in a "Cc:" header */
    static final int WhereCC = WhereFROM + Kind_N;
    /** seen in a "Bcc:" header */
    static final int WhereBCC = WhereCC + Kind_N;
    static private final int Where_N = WhereBCC + Kind_N;
    static private final String StrWhere[] = { "To", "From", "Cc", "Bcc" };

```

FIG. 7a

```

// Java will initialize counts to 0
private int counts[] = new int[Where_N];

Date newest;
Date oldest;

public Date getOldest ()
{
    return oldest;
}

public Date getNewest ()
{
    return newest;
}

/** @param what Should always be of the form (From?? + Kind?? + Where??) */
void incrementCount(Date d, int what) {
    counts[what]++;
    if (null != d) {
        if (null == newest) {
            oldest = newest = d;
        } else {
            long nms = d.getTime();
            if (nms > newest.getTime()) {
                newest = d;
            } else if (nms < oldest.getTime()) {
                oldest = d;
            }
        }
    }
}

/** @param what Should always be of the form (From?? + Kind?? + Where??) */
int getCount(int what) {
    return counts[what];
}

/** Set all counters to zero. */
void clear() {
    int i = 0;
    while (i < Where_N) {
        counts[i++] = 0;
    }
    nonZeroTotal = CountNONE;
    orderingValue = CountNONE;
    oldest = newest = null;
    duration = CountNONE;
    density = CountNONE;
    freshness = DCountNONE;
}

/** Get total number of messages this contact actually appeared in.
 * Since we add To:s to Cc:s and Cc:s to Bcc:s, we just need to count
 * From:s and Bcc:s. */
private int getMessageCount() {
    return (counts[FromME + KindCOMPOSITION + WhereFROM] +
            counts[FromME + KindREPLY + WhereFROM] +
            counts[FromME + KindFORWARD + WhereFROM] +
            counts[FromOTHER + KindCOMPOSITION + WhereFROM] +
            counts[FromOTHER + KindREPLY + WhereFROM] +
            counts[FromOTHER + KindFORWARD + WhereFROM] +
            counts[FromME + KindCOMPOSITION + WhereBCC] +
            counts[FromME + KindREPLY + WhereBCC] +
            counts[FromME + KindFORWARD + WhereBCC] +
            counts[FromOTHER + KindCOMPOSITION + WhereBCC] +
            counts[FromOTHER + KindREPLY + WhereBCC] +
            counts[FromOTHER + KindFORWARD + WhereBCC]);
}

```

FIG. 7b


```

private long duration = CountNONE;
public long getDuration() {
    if (CountNONE == duration) {
        if (null != oldest) {
            duration = newest.getTime() - oldest.getTime();
        } else {
            duration = 0;
        }
    }
    return duration;
}

private long density = CountNONE;
public long getDensity() {
    if (CountNONE == density) {
        long dur = getDuration();
        if (0 < dur) {
            density = getMessageCount() / dur;
        } else {
            density = 0;
        }
    }
    return density;
}

private double freshness = DCountNONE;
public double getFreshness() {
    if (DCountNONE == freshness) {
        freshness = (((double)getDensity()) /
            ((double)(new Date()).getTime() - newest.getTime())));
    }
    return freshness;
}

private int nonZeroTotal = CountNONE;
int getNonZeroTotal() {
    if (CountNONE == nonZeroTotal) {
        nonZeroTotal = 0;
        int i = 0;
        while (i < Where_N) {
            nonZeroTotal += counts[i];
            i += 1;
        }
    }
    return nonZeroTotal;
}

private int orderingValue = CountNONE;
// MLC:
public int getOrderingValue() {
    if (CountNONE == orderingValue) {
        orderingValue =
            counts[FromME + KindREPLY + WhereTO] * 1000000 +
            counts[FromME + KindCOMPOSITION + WhereTO] * 10000 +
            counts[FromOTHER + KindREPLY + WhereFROM] * 100 +
            counts[FromOTHER + KindCOMPOSITION + WhereFROM] * 100 +
            getNonZeroTotal();
    }
    return orderingValue;
}

```

FIG. 7c

```

private String print1(String leader, PrintWriter ps, int what)
throws IOException {
    if (0 != counts[what]) {
        int iFrom = what % From_N;
        int iKind = (what % Kind_N) / From_N;
        int iWhere = what / Kind_N;
        ps.print(leader+StrFrom[iFrom]+StrKind[iKind]+StrWhere[iWhere]+
            "+" + counts[what]);
        leader = " ";
    }
    return leader;
}

public void print(PrintWriter ps, int format) throws IOException {
    switch (format) {
        case MATData.FormatANALYSIS:
            String leader = " {";
            int what = 0;
            leader = print1(leader, ps, FromME + KindREPLY + WhereTO);
            leader = print1(leader, ps, FromME + KindCOMPOSITION + WhereTO);
            leader = print1(leader, ps, FromOTHER + KindREPLY + WhereFROM);
            leader = print1(leader, ps, FromOTHER + KindCOMPOSITION + WhereFROM);
            while (what < Where_N) {
                switch (what) {
                    case FromME + KindREPLY + WhereTO:
                    case FromME + KindCOMPOSITION + WhereTO:
                    case FromOTHER + KindREPLY + WhereFROM:
                    case FromOTHER + KindCOMPOSITION + WhereFROM:
                        break;
                    default:
                        leader = print1(leader, ps, what);
                        break;
                }
                what++;
            }
            if (leader.equals(" ")) {
                ps.print(")");
            }
            break;
        case MATData.FormatTERMINAL:
            int what2 = 0;
            String leader2 = " {";
            while (what2 < Where_N) {
                leader = print1(leader2, ps, what2++);
            }
            if (leader2.equals(" ")) {
                ps.print(")");
            }
            ps.print(" score="+getOrderingValue());
            break;
        case MATData.FormatDATABASE:
            break;
    }
}
}

```

FIG. 7d

```

package com.att.research.mat.mail;

import com.att.research.mat.utility.UniqueIDs;
import com.att.research.mat.utility.NumberedMember;
import java.util.Enumeration;
import java.io.PrintWriter;
import java.io.IOException;
import java.io.StringWriter;
import java.util.Date;

/** A list of contacts that appeared together on a To, CC, or Bcc line. */

public class MATContactGroup extends UniqueIDs {
    /** Copyright (c) 1999 AT&T Labs */
    static public String Copyright = "Copyright (c) 1999 AT&T Labs";

    /** @serial cc not stored */
    private MATContacts cc;

    // MLC:
    public MATContacts getMATContacts ()
    {
        return cc;
    }

    public MATContactGroup(MATContacts cc) {
        this.cc = cc;
    }

    public Enumeration elements() { return elements(cc); }

    public void hideUnimportantMembers(int threshold) {
        Enumeration e = elements(cc);
        while (e.hasMoreElements()) {
            ((MATContact)e.nextElement()).hideIfUnimportant(threshold);
        }
    }

    public boolean containsMe() {
        Enumeration e = elements(cc);
        while (e.hasMoreElements()) {
            if (((MATContact)e.nextElement()).isMe()) {
                return true;
            }
        }
        return false;
    }

    /** @return Unique id of removed member. */
    public int removeMe() {
        int i = 0;
        Enumeration e = elements(cc);
        while (e.hasMoreElements()) {
            MATContact c = (MATContact)e.nextElement();
            if (c.isMe()) {
                removeElementAt(i);
                return c.getUniqueID();
            }
            i++;
        }
        return NumberedMember.IdNONE;
    }
}

```

FIG. 8a

```

public MATContactGroup updateRemoveMe() {
    int removedMe = removeMe();
    if (NumberedMember.IdNONE != removedMe) {
        int others = toMATContactID();
        MATContactGroup meGroup = new MATContactGroup(cc);
        meGroup.addElement(removedMe);
        meGroup.addElement(others);
        meGroup.sortIds();
        return meGroup;
    } else {
        return null;
    }
}

public int toMATContactID() {
    switch (size()) {
        case 0:
            return NumberedMember.IdNONE;
        case 1:
            return uniqueIdAt(0);
        default:
            int removedMe = removeMe();
            if (NumberedMember.IdNONE != removedMe) {
                int others = toMATContactID();
                MATContactGroup meGroup = new MATContactGroup(cc);
                meGroup.addElement(removedMe);
                meGroup.addElement(others);
                meGroup.sortIds();
                MATContact c = cc.find(meGroup);
                c.setHidden(true);
                return c.getUniqueID();
            } else {
                sortIds();
                return cc.find(this).getUniqueID();
            }
    }
}

/** Calls {@link com.att.research.mat.email.MATContact#incrementCount(Date,int)}
 * for each member. */
void incrementCount(Date d, int what) {
    Enumeration e = elements(cc);
    while (e.hasMoreElements()) {
        ((MATContact)e.nextElement()).incrementCount(d, what);
    }
}

/** Needed by the contact the viewer. */
// This method MUST use cc, and cannot get it as an argument.
// This is the only true reason that cc must be a member of this object.
public String toString() {
    StringWriter sw = new StringWriter();
    PrintWriter ps = new PrintWriter(sw);
    try {
        print(ps, cc, " ", MATData.FormatADDRESS_ONLY);
    } catch (IOException e) {
    }
    return sw.toString();
}
}

```

FIG. 8b